Weekly Report for 08/04/2014

Highlights

- This is a five-week report. (Kathy Harkay)

- Submitted a report for the SSRL DOE Triennial Review. (Kathy Harkay)

- Presented "Investigation of Using Injection Kickers with MPS for Protection of SCUs" to ASD management. Co-authors: J. Dooling, F. Lenszus, R. Laird, J. Wang. (Kathy Harkay)

- Reviewed four LDRD proposals under the X-Ray Sciences initiative for D. Mills. (Kathy Harkay)

- With J. Dooling, tested a beam abort using injection kickers with SCU0 at 650 A main coil current and it did not quench. This is proof-of-principle that a controlled beam abort resulting in a very low ID6 beam loss charge can prevent a quench. (Kathy Harkay)

- Modeled multi-bunch trajectories with different abort kicker configurations in elegant and analyzed bunch loss positions. Found a promising solution using IK5 as a horizontal kicker with longer pulse, with the addition of a collimator in the extrusion at 38B:Q2. Prepared slides to present next week. (Kathy Harkay)

MCR Operations

Storage Ring Operations

- At weekly machine physics meeting, reported that new 5-mm ID chamber with new transiton design was planned to be installed during the Sept shutdown, and suggested we measure the local impedance and single-bunch limit before and after. Followed up and distributed emails relating to this decision, since ASD management was unaware of this plan. (Kathy Harkay)

- Followed up with D. Robinson on a case where SCU0 was not turned back on authomatically after waiting for the LHe pressure to fall below the return pressure after a beam-dump-induced quench. Participated in an email dialog answering some of his questions about SCU0 operations. (Kathy Harkay)

- Followed up with M. Smith on another case where SCU0 was not turned back on automatically afer a beam-dump-induced quench. (Kathy Harkay)

APS Machine Studies

Storage Ring Studies

- Continuing local impedance measurement with improved method - running DP during the measurement and inject the largest bunch to bucket 0. (Aimin Xiao)

- Worked with hairong on fixing orbit control law popup error when the configuration doesn't include P0 and P1 BPMs. (Aimin Xiao)

- Participated in kicker studies with J. Dooling on 7/29. Repeated testing IK1+IK4 at 14 kV to dump the beam (IK4 shifted by 0.5 turn), and confirmed that ID6 BLM loss charge is very low. Tested once with SCU0 turned on with 650 A main coil current, and it did not quench! Also tested a two-turn kicker configuration discussed under Storage Ring R&D. This was unsuccessful: only 75 mA was lost and ID6 BLM loss signal was reduced by about half. Finally, tested a new circuit that triggers the kickers with MPS (F. Lenszus and R. Laird) but excludes the injection trigger. Based on the BLM signals, it appeared that the kickers were firing too late, after the beam already spiraled in. We traced this to a fixed 350 usec delay and discussed it with F. Lenkszus. (Kathy Harkay)

- Participated in kicker studies with J. Dooling on 8/5, with the goal of calibrating ID6 BLM with a known beam loss, as suggested by S. Zholents. Carried out trajectory modeling and found IK2 10 kV kicks single bunch into ID6. We scanned the bunch timing relative to IK2 and found a range of

bunches that gave a single-turn BLM signal at ID6 and nothing at ID33. The results were very consistent with the model. We found that the peak of IK2 appears to be shifted with respect to bucket/bunch 0. Provided J. Dooling with figures that he added to slides we presented at weekly machine physics meeting. (Kathy Harkay)

• Participated in kicker studies with J. Dooling, A. Xiao, and W. Berg on 8/12. First part was to implement a kicker configuration to dump beam preferentially in ID10, the location of the scintillator (a.k.a. transverse beam loss monitor, or TLM). I found a solution that gave -18 mm amplitude at ID10: IK1 at 8.45 kV. J. Dooling proposed adding a bump to reach the wall, and I computed that -3 mm would be sufficient. A. Xiao knobbed in the bump. We acquired several single-bunch-kicked beam dumps and easily observed flashes on the scintillator even with small bunch charge, captured by video. The second part of the studies was to repeat the ID6 BLM calibration with lower PMT voltage. Prepared draft slides for the weekly machine studies meeting but said meeting was canceled. (Kathy Harkay)

• Continued SCU0 beam loss studies with K. Harkay. This time calibrating the BLMs in ID6. Presented initial results at the TOM. (Jeff Dooling)

ITS Studies

• Met with N. Sereno and Y. Sun to discuss upcoming stress testing of the 3G2 gun in the ITS. (Jeff Dooling)

APS Machine Research and Development

Storage Ring Research and Development

• Participated in a discussion of AOP group projects at weekly physics meeting. Proposed HOM dampers be installed on all cavities rather than develop a longitudinal feedback system. Proposed that the limited space in the ring would be better utilized with a dedicated beam abort system. (Kathy Harkay)

• Investigated additional injection kicker configurations using the elegant trajectory analysis; this is to test dumping the beam in a safe, controlled location to protect SCU0 and SCU1. Followed up on M. Borland's suggestion of a two-turn solution using kickers setpoints at operational levels or less, and found a potential solution using IK2+IK3 on turn 0 and IK1+IK4 on turn 1. (Kathy Harkay)

• Implemented multi-bunch elegant trajectory analysis of kicker configurations. The kicker waveform is offset in time according to the case under study, digitized at 24-bunch spacing, and the kicker voltage is passed to elegant. J. Dooling showed me how to pass variables into elegant in a script, which enabled higher-throughput case study. (Kathy Harkay)

• Modeled trajectories with IK1+IK4 configuration with multi-bunch analysis. Noted that bunches on the rising edge of the kicker pulse survive the first turn. Added multi-turn analysis for bunches that survive in a separate elegant analysis, using the kicker voltage at n+24. (Kathy Harkay)

• Modeled trajectories with IK5 assuming it is converted to a horizontal kicker with pulse length twice as long as present (feasible in principle per Ju. Wang). Found that 14.5 kV kicks beam into the wall at 38B:Q2. Analyzed multi-bunch trajectories and loss positions. Modeled second turn with a separate IK5 element in elegant, using the kicker voltage at n+24. Noted that adding a collimator with -2.5 cm aperture at 38B:Q2 catches most of the bunches that pass and get lost on the septum. With 16 kV, about 8% of the beam is lost on the septum, and with 14 kV, about 17% is lost. This could be further optimized. (Kathy Harkay)

Linac Research and Development

• Prepared presentation and participated in the dry-run for PCGun linac installation readiness review scheduled for Wednesday 8/13, presenting drive-laser status. (Jeff Dooling)

• Reviewed the pc gun laser injection mirror cross in 400A with R. Keane (ASD-DIA), J. Hoyt, and M. Martens (both AES-MOM). Pulling apart cross to allow reflectance measurement testing in the Laser Room. (Jeff Dooling)

Other Research and Development

• Electron cloud R&D: Met several times with L. Boon to discuss her thesis and progress on the QE paper. L. Boon applied reflectivity curves for C on Al and Al to the theoretical curves and compared the fits with the data. Given that the Al samples had been exposed to air, we discussed whether to use reflectivity curves for Al2O3 on Al, and we decided to consult with R. Rosenberg for his advice. (Kathy Harkay)

• Cathode R&D: Participated in telephone conference with SRC and IIT, also M. Fisher (AES/MED). We discussed the Wisconsin FEL SRF gun and the possibility of using it to test new SC cathodes. (Kathy Harkay)

• Cathode R&D: Met with M. Fisher (AES/MED), who showed us detailed drawings of the Wi-FEL SRF gun. Invited IIT collaborators to join the meeting (J. Zasadzinski, Z. Yusof, L. Spentzouris). (Kathy Harkay)

• Graphene window LDRD: Participated in aligning the laser on the graphene window test chamber. Worked with M. Smith to get the EPICS data logging set up. The laser was used to monitor graphene window integrity during pumpdown, He leak, and break tests. Acquired EPICS data for two samples. (Kathy Harkay)

• Graphene window LDRD: Discussed the project with R. Gulotty (CNM student). He explained the various graphene and related windows for testing and how he fabricated them. He described how he used a laser to etch the sample. We discussed how in a gun, the drive laser would have to pass through the window if it's used to isolate the vacuum from the cathode (per the proposal). We did preliminary calculations of the laser power and pulse energy density on the graphene to estimate survival. It may be worth doing actual tests with the PC gun drive laser. (Kathy Harkay)

• Graphene window LDRD: Ordered an optical breadboard to replace the borrowed optical table so that the graphene tests can continue. (Kathy Harkay)

APS Machine Software

AOP Applications Software

• Start updating and debugging ibs_tracking routins inside elegant. Found a bug related to output file. Still try to find a way to fix it. (Aimin Xiao)

Injectors

• removed B:QF:triggerOffsetAI and B:QD:triggerOffsetAI from booster injection data logger which are obsolete now. (Hairong Shang)

• fixed a bug in set InUse BPMs (of SROrbitControllaw) when there are no P0 or P1s. and added Clear FF BPM setpoints button (not tested yet). (Hairong Shang)

• improved BIRampWaveformMon to reprocess SD-I using B:SD:CurrentWF in IRef (and same for other magnets) in case that B:SD:CurrentWF was updated but SD-I was not, which caused the computation of dI went wrong becuase it uses SD-I. (Hairong Shang)

• modified BRampAutoCorr to not archive booster ramp waveforms because it generates too many files every day. (Hairong Shang)

General

• tested and debugged the segmentation fault of ExperimentDesigner which caused the GUI disappear, found the current oagwish version does not work well with "pv umon", changed back to use oagwish8.5 and ExperimentDesigner works fine. (Hairong Shang)

• implemented LiberaGDXTestBench per Diag's request for testing and controlling Libera GDX box using ssh, so that people can perform tasks simply through clicking buttons, instead of login to the machine and typing a lot of commands. (Hairong Shang)

Publications, papers and report

• Reviewed several drafts of the SCU0 thermal analysis paper for AAC14 and provided comments to Y. Shiroyanagi. (Kathy Harkay)

• Completed and submitted tech note on 3G1 testing, entitled 'Low-Level Testing of RF Thermionic Cathode Gun 3G1', AOP-TN-2014-037 with Y. Sun and N. Sereno. (Jeff Dooling)

Meetings, workshops, conferences, committees, LMS related, and reviews

• Submitted a report for the SSRL DOE Triennial Review. (Kathy Harkay)

• Participated in a teleconference with P3 Organizing Committee to decide on the list of speakers. Contacted three proposed speakers to invite them. (Kathy Harkay)

• Reviewed four LDRD proposals under the X-Ray Sciences initiative for D. Mills. (Kathy Harkay)

Education, Mentoring and outreach

• Met with an undergraduate student and gave her and her father an APS tour. (Kathy Harkay)

Miscellaneous

• Call for TOM meeting. (Aimin Xiao)

• Preparing machine study schedule for next week. (Aimin Xiao)

• took 1 sick leave, and 2 days (4 half days) vacation. (Hairong Shang)

• Jury duty (one day). (Kathy Harkay)

• Organized a B&A seminar for A. Blednykh (hosted by M. Borland). (Kathy Harkay)

• Participated in deliberations in the postdoc search committee. (Kathy Harkay)